

The Riverside Industrial Park Superfund Site (Site) and the Lower Passaic River (which is part of the Diamond Alkali Superfund Site) share a common boundary. This boundary is defined by the shoreline structures and bulkheads located on Lots 57, 60, 61, 63, 64, 66, 67, 69, and 70. Since the Site was built on property reclaimed from the river by progressive placement of fill material, these shoreline structures and bulkheads were constructed piecemeal over time and consist of various materials, including steel sheet piling, concrete, and wood. While the steel sheet piling and concrete bulkheads are in fair to good condition (GSH, 2019)¹, the wooden bulkheads on Lot 60, 63, 67, 69, and 70 are in poor condition (GSH, 2019) and in some cases have collapsed (such as Lot 67 and Lot 69) and vegetation now covers the shoreline and bulkhead remnants.

Several migration pathways cross this common boundary, allowing contaminants to be transported between the Site and the Lower Passaic River. Potential contaminant migration pathways from the Site to the river include: stormwater runoff to the river, groundwater discharge to the river, sewer pipe discharge to the river, and erosion and transport of soils to the river. Conversely, the Lower Passaic River can interact with the Site during flooding events when suspended solids from the river are transported and deposited onto the Site, or when surface water and groundwater interact and mix during high tide. Because of these interactions, the Site can be an ongoing source of contamination to the Lower Passaic River, and likewise, the river could be an ongoing source of contamination to the Site. The following sections examine these potential interactions to further develop the conceptual site model.

IMPACTS ON THE SITE FROM THE RIVER

The Lower Passaic River can interact with the Site during flooding events when suspended solids from the river are transported and deposited onto the Site, or when surface water and groundwater interact and mix during high tide. Flooding occurs at the Site when the high tide water elevations submerge the approximately 7-foot high bulkhead/shoreline structures. However, according to the Federal Emergency Management Agency (FEMA) flood maps, the Site is in an area designated as having a 0.2 percent chance of annual flooding or 1 percent annual chance of flooding with an average depth of less than 1 foot. Consequently, there are few flooding events that occur at the Site. Nevertheless, to investigate the potential impacts of flooding on the Site, seven soil samples were collected along the boundary between the Site and the Lower Passaic River and analyzed for polychlorodibenzodioxin/furan (PCDD/F) congeners (a known contaminant in the Lower Passaic River). Five of these seven samples represented 0-6 inches of surface soil, and the other two were collected more than 6 feet bgs under impervious surfaces (concrete or asphalt). The 2,3,7,8-TCDD concentration in these five surface soils ranged from 0.377 ng/kg to 20.8 ng/kg, averaging 8.9 ng/kg. These levels are significantly lower (by approximately two orders of magnitude) than the average 2,3,7,8-TCDD concentration measured on suspended solids in the river (which is approximately 1,000 ng/kg) (EPA, 2016)². The transport of Passaic-contaminated solids can also be monitored by tracing the river's distinct 2,3,7,8-TCDD/Total TCDD fingerprint ratio of 0.7 (EPA, 2014)³. In the five surface soil samples collected at the Site, the 2,3,7,8-TCDD/Total TCDD ratio ranged from about 0.1 to 0.3. Because of the low ratio in Site surface soils and low concentrations, the 2,3,7,8-TCDD detected at the Site is unlikely to have originated from the Lower Passaic River. It should also be noted that Lower Passaic River suspended solids are also contaminated with pesticides, particularly Dieldrin and DDT isomers. However, pesticides were not detected in the surface soils

¹ Glenn Springs Holdings, Inc., 2019. "Preliminary Bulkhead and Shoreline Assessment Report." Prepared by Tetra Tech. Revision 1, May 2019.

² EPA, 2016. "Record of Decision for Lower 8.3 Miles of the Lower Passaic River, Part of the Diamond Alkali Superfund Site Essex and Hudson Counties, New Jersey." EPA Region 2. March 3, 2016.

³ EPA, 2014. "Remedial Investigation Report for Lower 8.3 Miles of the Lower Passaic River." Prepared by The Louis Berger Group, Inc. in conjunction with Battelle and HDR|HydroQual. 2014.

collected across the Site. Together, these lines of evidence show that the river is not a significant source of contamination to the Site.

The surface water from the river can also interact with the groundwater under the Site during high tide events and tidal pumping. This interaction is highlighted by the brackish groundwater quality observed on the Site in shallow monitoring wells (constructed to approximately 10 feet bgs) and deep monitoring wells (constructed to approximately 20 feet bgs). Groundwater had elevated conductivity values reported during field screening and elevated concentrations of sodium and other salts reported by the laboratory, which are indicative of salt water intrusion. Along with these salts, surface water may also be transporting contaminants from the river to the groundwater. However, based on the Baseline Human Health Risk Assessment (BHHRA), under future commercial/industrial land use, the cumulative cancer risk and Hazard Index (HI) estimates for exposure to soil and groundwater do not exceed USEPA's cancer risk range and non-cancer goal of protection of an HI = 1 for the Reasonable Maximum Exposure (RME) individual, except for indoor worker exposure to soil via vapor intrusion on select property lots. Because Lower Passaic River surface water is constantly flowing and the water column is mixed twice a day with the advancing and retreating salt front, it is unlikely that there are significant concentrations of volatile compounds remaining in the surface water to be transported from the river to the groundwater to contribute to this potential risk.

IMPACTS ON THE RIVER FROM THE SITE

The Site can also interact with the Lower Passaic River from stormwater runoff to the river, groundwater discharge to the river, sewer pipe discharge to the river, and erosion and transport of soils to the river. As documented in the Site history (RI Section 1.2.3), there have been many illegal releases to the river dating back to the early twentieth century, including solid waste disposal and pipe discharge. Based on the RI data, contaminated groundwater and contaminated sewer water continue to be released to the Lower Passaic River. For example, sewer water from pipe P-57 contained acetone at 83,000 ug/L and ethyl acetate (reported as a TIC) at 70,000 ug/L. Monitoring well MW-118 located adjacent to the river also had acetone concentrations ranging from 51,000 to 71,000 ug/L during the three groundwater sampling events. Since groundwater predominantly flows east towards the river, contaminants in the groundwater could discharge to the river, including free product that has been mobilized. The Site has underground storage tanks (USTs) on Lot 64 containing free product that has impacted the surrounding soils and observed in soil borings (RI Appendix C) and in historic test pits (Tetra Tech, 2012).⁴ Monitoring wells and temporary well points in the vicinity of the USTs did not have a measurable thickness of NAPL, but they did have elevated BTEX levels, which are indicative of petroleum impacts to groundwater. Free product was also observed during the construction of monitoring well MW-201 on Lot 63 and temporary well point B-34 on Lot 64. Based on the groundwater flow patterns, these contaminants are flowing towards the river and ultimately discharging contaminant load to the river.

Lower Passaic River sediment is also a potentially affected medium from the Site. The most significant impacts to the sediment are from erosion and transport of contaminated soils from stormwater runoff to the river and erosion and transport of contaminated soils along bulkhead/shoreline structures. Approximately 72 percent of stormwater runoff flows towards the river. Soil erosion is visibly evident along the eastern boundary of the Site on pervious surfaces where soil erosion has created channels and crevices in the surface soils. River flows have also caused soil erosion along the bulkhead/shoreline structures. Three examples of soil erosion along the bulkhead/shoreline structures include: (1) the undermining of the concrete wall on Lot 57 and Lot 60 (as observed with void spaces underneath the

⁴ Tetra Tech, 2014. "Amended Draft Sampling Trip Report for the Riverside Avenue Site." March 23, 2012.

concrete during drilling), (2) the sink holes observed on Lots 63, 64, and 66, and (3) the collapsed or deteriorating wooden bulkheads on Lot 63 (behind Building 7), Lot 60 (behind Building 1), Lot 70 (behind Building 16), and Lot 69 (behind Building 19). At these locations, the Lower Passaic River is in contact with contaminated soils from the Site and is eroding soils that are ultimately deposited on the river bed.

A remedial action that includes bank-to-bank capping is being designed in the lower 8.3 miles of the Lower Passaic River, in accordance with the March 2016 Diamond Alkali Operable Unit 2 (OU2) Record of Decision (ROD). The Diamond Alkali OU2 ROD sets remedial goals and established background levels (where remedial goals were not set) for the lower 8.3 miles of the Lower Passaic River. Relevant remedial goals and background levels include: Total PCB with a remedial goal of 50 ug/kg, mercury with a remedial goal of 74 ug/kg, lead with a background level of 130 mg/kg, and copper with a background level of 63 mg/kg. The Site has a Remedial Action Objection (RAO) to address potential interactions between the Site and the river from ongoing contamination. While suspended solids in stormwater runoff of eroding soils were not directly sampled during the RI, soil borings were collected along the bulkhead/shoreline structures in Lots 57, 60, 61, 63, 64, 66, 67, 69, and 70. Soil samples from these borings (totaling 18 borings with 36 corresponding soil samples) are representative of the type of soils that are potentially eroding and in contact with the Lower Passaic River. The following table characterizes the concentrations of mercury, lead, copper, and Total PCB in these soils, showing that soils adjacent to the bulkhead/shoreline structures (and representative of eroding soils) are frequently in exceedance of the Diamond Alkali OU2 remedial goals and ROD background levels based on the geometric mean and median values.

Parameter	Units	Minimum Level in Soil Borings	Maximum Level in Soil Borings	Location of Maximum Level in Soil Borings	Site Statistics	Diamond Alkali OU2 ROD Remedial Goal or Background	Frequency of Site Samples Exceeding OU2 ROD Value
Mercury	ug/kg	20	12,300	B25 (5.0-5.5 feet bgs)	Mean = 1,780 Geomean = 597 Median = 500	74	33/36
Lead	mg/kg	29.7	6,210	B30 (3.0-3.8 feet bgs)	Mean = 1,137 Geomean = 426 Median = 385	130	28/36
Copper	mg/kg	19.1	1,040	B33 (0.5-1.5 feet bgs)	Mean = 135 Geomean = 87 Median = 82	63	24/36
Total PCB	ug/kg	43.3	10,041	B67 (2.5-3.8 feet bgs)	Mean = 537 Geomean = 115 Median = 103	50	22/36

Note 1: Statistics based on 18 borings with 36 corresponding soil samples from 0-13 feet bgs. Borings include: B9, B10, B23, B24, B25, B30, B32, B33, B51, B53, B63, B65, B67, B71, B74, B84, B87, and B88.

Note 2: Field duplicates were collected during the RI field program. Field duplicates were collected at B24 and B87; however, only the parent concentration was used in the statistics.

Note 3: Total PCB is the sum of Aroclor 1254 and Aroclor 1260, which are frequently detected in these soil samples. Nondetects are incorporated into the summation at the quantitation limit. If both Aroclors were nondetected, then the maximum quantitation limit is used to represent the summation.

The Total PCB statistics would change as follows if nondetects were substituted as zero in the summation (units of ug/kg): Mean = 525, Geomean = 95, Median = 71, and Exceedance frequency = 19/36.

In addition to examining these 18 soil borings collected along the bulkhead/shoreline structures collectively, an additional comparison was completed for borings located adjacent to collapsed bulkhead/shoreline structures for mercury, lead, and copper.

- Soil samples from three borings (B30, B32, and B87) collected behind Building 7 on Lot 63 are representative of the soils eroding behind the collapsing wooden bulkhead. In these samples, exceedances were observed in all samples with mercury ranging from 1,100 ug/kg to 5,200 ug/kg compared to the Diamond Alkali OU2 remedial goal of 74 ug/kg; lead ranging from 1,690 mg/kg to 6,210 mg/kg compared to the Diamond Alkali OU2 ROD background value of 130 mg/kg; and copper ranging from 109 mg/kg to 337 mg/kg compared to the Diamond Alkali OU2 ROD background value of 63 mg/kg.
- Soil samples from boring B63 collected behind Building 19 on Lot 69 are representative of the soils eroding behind the collapsed wooden bulkhead. In the two samples from this boring, frequent exceedances were observed with mercury detected at 140 ug/kg and 350 ug/kg compared to the Diamond Alkali OU2 remedial goal of 74 ug/kg; lead detected at 126 mg/kg and 440 mg/kg compared to the Diamond Alkali OU2 ROD background value of 130 mg/kg; and copper detected at 31.6 mg/kg and 83.2 mg/kg compared to the Diamond Alkali OU2 ROD background value of 63 mg/kg.
- Soil samples from boring B84 is the closest boring to the sink hole located between Building 17 and Building 7 and is representative of the soils potential eroding in the sink hole. In the two samples from this boring, frequent exceedances were observed with mercury detected at 42 ug/kg and 9,600 ug/kg compared to the Diamond Alkali OU2 remedial goal of 74 ug/kg; lead detected at 29.7 mg/kg and 236 mg/kg compared to the Diamond Alkali OU2 ROD background value of 130 mg/kg; and copper detected at 20.4 mg/kg and 190 mg/kg compared to the Diamond Alkali OU2 ROD background value of 63 mg/kg.

These data suggest that the Site is an ongoing source of contamination to the Lower Passaic River and may re-contaminate the Diamond Alkali OU2 remedy if left unaddressed.